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Issued April 16, 1912.

U. S. DEPARTMENT OF AGRICULTURE.

FARMERS' BULLETIN 491.

THE PROFITABLE MANAGEMENT OF THE
SMALL APPLE ORCHARD ON THE
GENERAL FARM.

BY

M. C. BURRITT,

*Assistant Agriculturist, Office of Farm Management
Bureau of Plant Industry.*



WASHINGTON:
GOVERNMENT PRINTING OFFICE.

1912.

LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF PLANT INDUSTRY,
OFFICE OF THE CHIEF,
Washington, D. C., February 1, 1912.

SIR: I have the honor to submit herewith a paper entitled "The Profitable Management of the Small Apple Orchard on the General Farm," which has been prepared by Mr. M. C. Burritt, Assistant Agriculturist in the Office of Farm Management of this Bureau.

This paper deals with the question of rejuvenating old apple orchards, which has been a subject of much inquiry. While the statistics used in connection with some of the discussions are compiled from data collected in a northern apple-growing region, the application of them is made from the standpoint of the problem in question and the fundamental principles involved.

As the subject matter covered by this bulletin falls within the province of Field Investigations in Pomology, the manuscript has been carefully revised and is submitted through the Office of Field Investigations in Pomology by Mr. A. V. Stubenrauch, Expert in Charge.

I recommend the publication of this manuscript as a Farmers' Bulletin.

Respectfully,

B. T. GALLOWAY,
Chief of Bureau.

Hon. JAMES WILSON,
Secretary of Agriculture.

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THE PROFITABLE MANAGEMENT OF THE SMALL APPLE ORCHARD ON THE GENERAL FARM

INTRODUCTION.

Throughout the humid regions of the United States there are large numbers of small apple orchards. In many sections there is scarcely a farm which has not its small home orchard. These orchards vary in size from a few trees to several acres. They were planted mainly for the purpose of having a home source of supply of this excellent and popular fruit. In most cases they were not intended as commercial plantings nor was the fruit grown for sale. They were planted in order to have apples to eat during the long winter evenings, to make the famous apple pies, and to lay in a stock of sweet cider and vinegar.

Farmers of earlier days knew little of scientific orchard management and cared less. It was sufficient for them to know that the trees lived, grew, and eventually bore fruit. Not being a source of income, the orchard was naturally left to take care of itself. As a result, where the conditions were favorable some very good trees were grown, but where they were unfavorable the trees became stunted, scrubby, diseased, and unproductive. As a rule set too thick, they grew up in the air, the lower limbs died or were pruned off to get them out of the way, and high-headed, almost unreachable trees were the result. The trees usually stood in sod, and in most of these orchards the hay was cut and removed or the grass pastured off. In many places the regular rotation of crops was followed in the orchard. Too often it was planted on the poorest soil, site, and location on the farm and received little or no care. Is it any wonder that these orchards have become unprofitable, not to say unsightly?

THE POINT OF VIEW.

Conditions have changed. Markets, local and foreign, have opened up and are demanding apples and are willing to pay a good price for them. To meet this demand thousands of acres of orchards have been planted in many sections of the United States, but it will take

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time to bring these younger orchards into bearing. Meanwhile many men have turned to these old general-farm orchards in the hope that



FIG. 1.—The type of apple orchard it pays to renovate. The trees are fairly young and vigorous and of good varieties. The orchard has been cropped in the regular rotation and has not been profitable. It could be made to pay in two years.

in their rehabilitation they may find profit in meeting this demand. If these old orchards can be rehabilitated they will at once (figs. 1 and 2) supply the market with needed fruit. Later, when the



FIG. 2.—A renovated orchard of four acres which produced \$1,100 worth of fruit the second year after renovation.

thousands of acres of newly planted trees come into bearing, it may be no longer profitable to maintain the old orchard in competition with younger and better orchards. Just at the present time, how-

ever, the opportunity to make money out of the old general-farm orchard is good in many instances.

While there is such a thing as too great diversification, it is ordinarily true that those farms which have several important sources of income are the most profitable. The farmer who devotes all his energy to one crop, except it be a highly specialized crop, to the neglect of all others fails to come up to his possibilities. The aim on the general farm should be not so much to make one crop more profitable than the others, but to get the most possible out of every crop.

The old apple orchard, be it 20 trees or 200, may form an important source of income on the general farm. An effort should be made to make this unit a productive one and so to rejuvenate and care for these old trees that they will contribute as much as they are able to the net farm income.

THE QUESTION.

The question as to whether it will pay to rejuvenate these old trees is frequently asked of the Department of Agriculture. Will it pay to fix up my old orchard of 50 trees? What should I do to make my 3-acre orchard profitable? What can be done to get a better income from our small orchard, which has been neglected for years? What will it cost and what returns may be expected? These and many similar questions require an answer.

THE ANSWER.

The above question finds at least a partial answer in data gathered in western New York by the New York State College of Agriculture at Cornell University. In surveys made in several of the leading apple-producing counties of that section, data have been secured from about 11,000 acres of orchards. Tables I and II, compiled from these data, will give the reader some idea of what returns can be expected from the average well-cared-for orchard in western New York. And this section is representative of a large region of country. The greater part of these orchards are between 30 and 40 years old and many of them did not receive the best of treatment in their early life. In a sense they have been renovated, although the greater number of them never were as badly neglected as are many orchards in eastern, central, and southern New York and in New England.

These orchards show average yields per acre in different years of 50 to 225 bushels. The price in different years varies from 50 cents to \$1 per bushel, probably averaging 75 cents. Thus it will be seen that a gross income ranging from \$37.50 to \$175 per acre may be depended on in most years. It should be pointed out that these

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figures were obtained from the most important commercial fruit-growing counties in the East and that they probably represent larger yields than can ordinarily be expected from a general-farm orchard. They are cited rather as possibilities which may be reached under the best methods of culture.

TABLE I.—*Number of orchards and acres surveyed in four counties in western New York from 1900 to 1908, with average yields.*¹

County and year.	Number of orchards.	Area surveyed.	Average yield per acre.	County and year.	Number of orchards.	Area surveyed.	Average yield per acre.
Wayne County:		<i>Acres.</i>	<i>Bushels.</i>	Niagara County:		<i>Acres.</i>	<i>Bushels.</i>
1900.....	189	1,687	229	1902.....	125	1,415	236
1901.....	318	2,282	32	1903.....	273	2,736	197
1902.....	416	3,067	206	1904.....	459	4,321	195
1903.....	200	1,621	265	1905.....	372	4,152	155
				1906.....	173	2,031	179
4-year average.	281	1,914	183	5-year average			
					280	2,931	192
Orleans County:				Monroe County:			
1900.....	176	1,581	241	1905.....			189
1901.....	212	1,972	63	1906.....			223
1902.....	356	3,195	248	1907.....			166
1903.....	485	4,345	224	1908.....			199
1904.....	283	2,869	284				
5-year average.	302	2,792	212	4-year average.	336	3,675	194

¹ From the orchard surveys of Wayne, Orleans, and Niagara Counties, Bulletins 226, 229, and 262, respectively, Cornell University Agricultural Experiment Station. Monroe County survey not yet published.

TABLE II.—*Average yield in bushels per tree in three counties of western New York from 1900 to 1906. Trees mostly 30 to 45 years old.*¹

County.	Year.							Average yield.
	1900	1901	1902	1903	1904	1905	1906	
Wayne.....	5.8	0.8	5.0	.....	.....	.....	.....	3.3
Orleans.....	5.8	1.5	6.0	5.4	6.8	.....	.....	4.6
Niagara.....	.....	.....	6.6	5.0	4.7	4.6	4.4	4.8

¹ From the orchard surveys of Wayne, Orleans, and Niagara Counties, Bulletins 226, 229, and 262, respectively, Cornell University Agricultural Experiment Station.

The answer is plain but must be qualified. In most cases it probably will pay to renovate the old farm orchard. In some cases it will not pay. First, let us see what classes or kinds of orchards it will be unprofitable to try to renovate and eliminate these. Then we may proceed to outline the steps to be taken in making the orchard profitable.

ORCHARDS IT WILL NOT PAY TO RENOVATE.

Those orchards on which it probably will not pay to spend much money or effort may be put into four classes:

(1) Orchards with less than 50 per cent of a stand of trees, especially when they are more than 40 years of age (fig. 3).

- (2) Orchards with poor or undesirable varieties.
- (3) Orchards on a poor or unsuitable soil or in an unfavorable site or location.
- (4) Orchards in which the trees are badly diseased and show very few signs of vigor.

SCATTERED OR VERY OLD ORCHARDS.

When the trees in an orchard do not occupy more than 50 per cent of the land it usually will not pay to cultivate all the land for these few unless the 50 per cent be very regularly distributed over the land. It is not as a rule advisable to fill in an old orchard with younger trees. Sometimes, however, this may be done if trees are not too old and where rapid-growing and early-bearing trees, such as Wealthy, Oldenburg (*Duchess of Oldenburg*), Yellow Transparent,



FIG. 3.—Types of apple trees it will not usually pay to renovate. They are too old, lack vigor, and are more or less diseased.

and Wagener, are used. When trees are older than 35 to 40 years the chances of successful renovation are very much less. Older trees should be in exceptionally good condition if renovation is to be attempted, as it is much more difficult to infuse vigor into old trees than into younger ones.

POOR VARIETIES.

It usually will not pay to renovate orchards composed largely of worthless or very poor varieties. Nothing is to be gained by increasing the yield or grade of a variety which can not readily be sold in the open market at a good price. When trees of such varieties, however, are not too old—not more than 30 years—and are in fairly good vigor, they often may be top-worked to advantage. The best method of doing this is by cleft-grafting in early spring. Under favorable

conditions a tree may be changed from a poor variety to a desirable one and made to bear fruit in from 3 to 5 years.¹

There is some question as to whether it will pay to renovate summer apples in the Northern States. To make renovation of these trees profitable requires either a good demand in the local market or exceptionally good transportation to and demand in a more distant market. Much the same is true of odd or uncommon varieties.

Some of the characteristics which make a variety poor are unattractiveness in shape, size, or color; inferior quality; lack of hardiness in tree or fruit, making them subject to disease; small production; and being comparatively unknown in the markets and therefore not in good demand. To make a variety worth renovating, then, it should be fair to good in quality; attractive; a fair or, better, a prolific producer; a good keeper and shipper; and in good demand at good prices in the market. All these factors should be considered before renovation is attempted.

UNFAVORABLE CONDITIONS.

An apple orchard set on a wet soil which can not be readily drained is worthless. Trees set on poor soils require too much fertilization to get them in shape to allow of much profit. Trees growing on soils that are too dry or leachy are less amenable to renovation. In like manner orchards located in frost pockets, at elevations too low or too high, on sites too much exposed, or on slopes too warm or too cold will not pay returns on the money spent in renovating them equal to the returns from those better situated. The renovation of orchards at a considerable distance from the railroad, with poor highways and poor shipping facilities, and in isolated and inaccessible places will not prove as profitable as the renovation of orchards in better locations. In short, orchards in sites or locations which are naturally unfavorable to apple growing will be more expensive to renovate and less profitable in the end, and, in fact, may not give any profitable returns because of these adverse conditions.

BADLY DISEASED TREES.

It costs considerably more to renovate a badly diseased orchard than one not so diseased. All disease must be eradicated by destroying infected parts and by spraying. Dead branches and limbs must be removed and the effect may be to seriously and permanently weaken the tree. Disease frequently stunts the growth to such an extent as to make it impossible to rejuvenate the tree. If vigor has

¹ For complete directions as to methods, time, etc., see Farmers' Bulletin 113, "The Apple and How to Grow It," and Yearbook, U. S. Department of Agriculture, for 1902, pp. 245-258, "Top-Working Orchard Trees," both of which may be obtained free on request to the Secretary of Agriculture, Washington, D. C.

been lost, no amount of stimulation will restore it. Good vigor, even though it be dormant, is absolutely essential in a tree if it is to be improved. Trees which have been frequently defoliated by scale or canker worms or in which apple-tree canker and rot have obtained a strong foothold are expensive to rejuvenate and less satisfactory when rejuvenated.

HOW TO RENOVATE AN ORCHARD.

Four important steps must be taken in the improvement of the general-farm orchard. These steps are practically the same as those which would be employed in the average orchard under normal conditions. With but little modification, the methods to be outlined may be continued after renovation. These are: (1) Pruning, (2) fertilization, (3) cultivation, and (4) spraying.

A general outline of work or a plan of campaign may be briefly summarized as follows, details being given later on:

(1) If the orchard is and has been in sod for a number of years, plow in the fall about 4 inches deep. If not, plow either in late fall or early spring.

(2) During the winter put on from 12 to 15 loads of barnyard manure per acre, or 1 load to from 3 to 5 trees. Another plan is to apply in the spring 100 to 200 pounds of nitrate of soda, 300 to 500 pounds of acid phosphate, and 150 to 300 pounds of sulphate or muriate of potash.

(3) In the winter or in early spring before growth starts, cut out all dead and diseased wood from the tree, head back the highest limbs, and thin the branches to admit sunlight.

(4) Apply 1,500 to 2,000 pounds of lime per acre and work it and the manure or fertilizer into the soil thoroughly with a disk harrow or spring-tooth harrow. Keep up this cultivation until midsummer.

(5) After cultivation ceases for the season, sow a cover or green-manure crop to plow under the following spring. Clover is one of the best leguminous crops in the North, while cowpeas are widely used in middle latitudes and in the South. For a nonleguminous crop rye is the most extensively used, though buckwheat is commonly used in some sections of the North.

(6) Spray the trees in accordance with the directions given in Government and State publications on this subject.

PRUNING.

Pruning is an early and important step. This operation has several distinct purposes, all of which should be kept well in mind.

Its first object will be to remove dead or injured wood. In doing this the cut should be made well behind the injured or diseased part and the wound should be left with smooth edges. (Fig. 4.)

The second object will be to shape the tree. If it is too high it should be headed back. It is most important to get the trees down



FIG. 4.—The wrong way to make a cut. The limb was cut off too far from the body of the tree and has rotted clear into the trunk.



FIG. 5.—The result of setting trees too close together and not thinning them out. The crowding of the trees has forced them to grow up in the air and has made the orchard look like a piece of timber. Still this orchard has been renovated and averages an income of \$150 per year. It hardly pays to head back trees as old and as large as these.

low enough so that the operations of spraying and pruning can be easily performed. (See figs. 5 and 6.) It will be found very necessary to do this heading back on most old orchards, as usually the

trees have been set close together, "trimmed up," and left to grow as high as they would. Most old orchards are much too high, a defect due both to too high heading in the first place and too high training subsequently. Five or ten feet may be safely removed if the work is properly done and good judgment used, cutting back the leaders of the uppermost branches and not cutting too much out of a tree in one year. (See fig. 7.)

In the third place, it will usually be necessary to thin out the smaller branches and in many cases even the larger limbs in order to admit plenty of sunlight to the leaves and fruit and to avoid too great competition among the branches. Thinning the branches thins the fruit also, enabling the fruit which remains to develop better than it otherwise would.



FIG. 6.—A tree which has been moderately headed back. Note that the leaders in the top of the tree have been removed, encouraging the growth of lateral branches. Note also the clean tillage.

Pruning during the winter or dormant season tends to stimulate growth and to make the tree more vigorous. This stimulation is often a very important result of early pruning; in fact, it is often essential thus to induce new vigor in the tree. Pruning may be done at any time during the dormant season, though it is best done in early spring just before the buds swell or growth starts.

All large wounds, or those over 2 inches in diameter, should be painted over with a coat of some such material as a heavy lead paint, which is probably best for the purpose, adding a little lampblack to make the color inconspicuous. This treatment excludes moisture and consequent decay and disease. If a tree has a bad crotch which is

splitting down, a half-inch or 1-inch iron bolt with a wide, thick washer at either end may be used to draw and hold the parting branches together. Such bolts are inserted through holes bored in the limbs. A limb that has rotted badly on one side or in the middle may be strengthened and the rot prevented from spreading by cleaning out the rotted portion thoroughly, disinfecting the bare surfaces, applying some such material as tar to form a waterproof layer, and filling the cavity with cement.

It may sometimes be necessary to remove some trees. Poor or unknown varieties are usually better cut down unless they can be top-

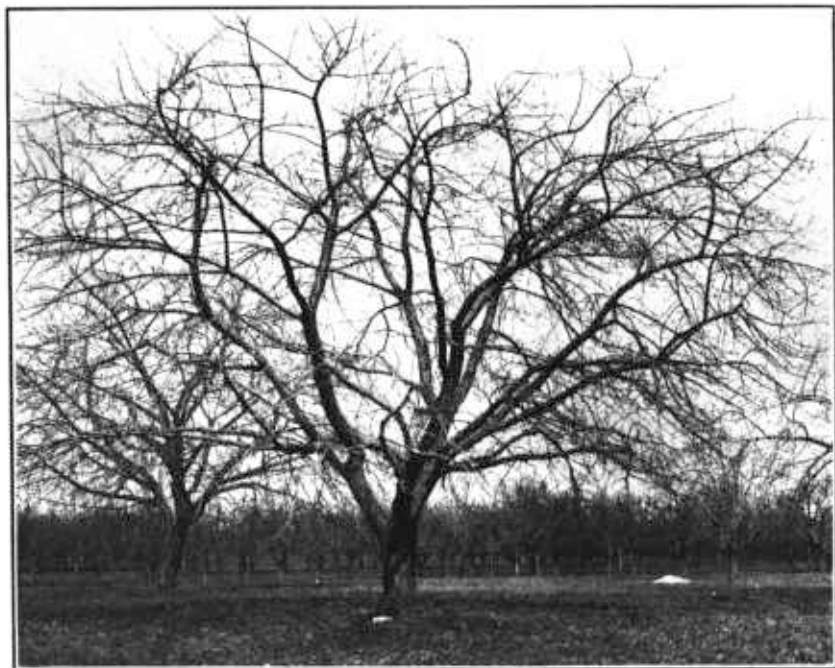


FIG. 7.—An ideal to strive for in pruning and shaping an apple tree. Note the distribution of the branches. This tree has produced as high as 20 barrels of fine fruit in one season and averages about 10 barrels per year.

grafted. Mature trees that are 30 by 30 feet apart or closer, as in many old orchards, are too close for profit. It is usually advisable to cut out the even or the odd trees in alternate rows in order to give the trees plenty of room to grow and the operator room to spray, cultivate, and pick the fruit.

The saw is the best all-around tool to use for pruning. It can conveniently be used for practically all cuts, and with it the edges will be made smooth. Shears and extension pruners may be used, but such tools are not generally so useful as the saw. Shears with handles about 2 feet long are more convenient than the saw for head-

ing back small limbs and for thinning out the ends of branches. An excellent type of saw is one about 20 inches long, about 4 inches wide at the butt, narrowing to about $1\frac{1}{2}$ inches at the point, thick enough to be rigid, and with but one cutting edge, which should always be kept sharp.

FERTILIZATION.

Most general-farm orchards have been left in sod for many years and are in sod at present. Many are cropped in the regular rotation and the crops removed from the land. In most cases no effort has been made to feed the trees or to keep up the fertility of the soil.

Apples are as much a crop as anything grown on the farm and should be so regarded. If the trees are not taken care of a farmer has no reason to expect that they will give good yields. When more than one crop is grown on the same land without extra care, fertilization, etc., good yields of both may not justly be expected. When this practice has been in vogue on a farm it may be expected that the orchard will be lacking in fertility. The growth of the trees will usually indicate the fact. If the tree looks scrawny and stunted and if examination shows either that no growth or but a few inches of annual growth are being made, it is certain that fertilization is one of the necessary requisites for rejuvenation.

The necessary plant food is best supplied by barnyard manure applied at the rate of 10 loads per acre for a light application or 20 loads for a heavy application. This amounts to a load for each two to five trees. Such an application will not only go far toward supplying the necessary nitrogen, phosphoric acid, and potash, but especially, of course, will add humus and help to improve the physical condition of the soil. Manure should be applied in the fall after plowing or during the winter, except on land that washes badly. It should not be piled near the trunk of the tree, but should be spread uniformly over the entire surface of the ground. It is particularly essential to spread the manure under and beyond the farthest extent of the branches, as the most important feeding roots penetrate this area.

Nitrogen produces strong wood growth, which is desirable on old trees not growing vigorously. It is easily possible to overdo the use of nitrogen and produce wood growth at the expense of fruit buds and fruit. Potash and phosphoric acid are found in larger proportions in the leaves and fruit. Good, vigorous twig growth, an abundance of large dark-green leaves, and fruit of good size are the most satisfactory proof of sufficient fertility.

Manure will usually supply the needed elements in sufficient quantity, if a medium to heavy application can be made. But if it can not be obtained commercial fertilizers may be resorted to. For the

first year about 200 pounds of nitrate of soda or 300 pounds of dried blood per acre should be applied broadcast in early spring and thoroughly worked into the soil with the spring-tooth harrow. It is well to apply the nitrate of soda in two applications a few weeks apart, especially on soils which are leachy and in wet seasons, as part of the nitrogen may leach away if it is all applied at once. It should also be applied a little later than the other fertilizers after growth has started. After the first year leguminous cover crops should be depended on for nitrogen. Then from 200 to 400 pounds of treated rock phosphate or basic slag and the same amount of sulphate or muriate of potash¹ should be used to furnish the other two elements. Thus a large amount of available plant food will be supplied to the tree and should result not only in better wood growth, but in the formation of vigorous leaf and fruit buds for the following year.

Lime is not usually a true fertilizer, except on soils markedly deficient in lime. It will usually be advisable to apply from 1,500 to 2,000 pounds of fresh-burned lime, or its equivalent, per acre in order to correct natural soil acidity, if there be any, to hasten the decay of organic material, to increase the activity of the soil bacteria, and to improve the physical condition of the soil by flocculating the soil particles and breaking up lumpy soils. Lime also helps to liberate plant food by recombining it with certain other elements. After this first heavy application of lime an additional 800 pounds may be applied about every four or five years.

CULTIVATION.

If an old apple orchard is in sod, especially if the sod is an old or stiff one, it should be plowed in the fall. Ordinarily, fall plowing is good practice in most orchards, but in cases where the soil is very loose and liable to wash and expose the roots to freezing, or where it is very heavy and apt to puddle when exposed to the weather, or in very cold climates where the snowfall is light, it is best to plow in spring. By turning under the grass, rubbish, etc., in the fall the process of decay and incorporation with the soil is hastened. A soil often becomes deadened or lifeless from long inertia, and when exposed to the action of moisture and frost its physical condition will be improved. A disk harrow may often be successfully used for the first breaking up of this sod preparatory to plowing.

It is never advisable to plow deeply in old orchards. Plowing should be only deep enough to turn under grass and other litter and

¹ Results obtained at the Massachusetts Agricultural Experiment Station and at the Pennsylvania State College Agricultural Experiment Station would indicate that sulphate is better than muriate of potash. See "Manuring the Apple Orchard," Twenty-Second Annual Report of the Massachusetts Agricultural Experiment Station, 1910, p. 10; also "Fertilization of Apple Orchards," Bulletin 100, Pennsylvania State College Agricultural Experiment Station.

cover it with soil. This depth will be from 3 to 5 inches, 4 being a good average and about right. It is always impossible to plow any old orchard which has long been down in sod without breaking a great many of the roots, which, of course, will be close to the surface, but it is desirable to break as few of these roots as possible; hence the necessity for shallow plowing. However, the danger of breaking roots should discourage no one from plowing, as the benefits derived under such conditions are many times greater than the damage done.

After fall-plowing a stiff sod, the best tool to use in the early spring to loosen up the surface soil and to work in any manure which may have been applied during the winter is the disk harrow. In very loose and open, deep soils the spring-tooth harrow will answer for this purpose, though not as well as the disk, which is the most effective implement, especially where there is a very stiff sod to be broken up or much coarse litter is on the surface. Still it will do very satisfactory work and on stony land is better than the disk harrow. The orchard should be gone over several times with one of these tools during the first month in which it is possible to get on the land, the sooner after growth starts the better.

After the soil has been worked into a fine mechanical condition, subsequent cultivation will be done largely in order to maintain a surface mulch to prevent the loss of moisture by evaporation and incidentally to kill and keep down weeds. For this purpose the spring-tooth harrow should be set more shallow or, better still, the spike-tooth or smoothing harrow should be used. The orchard should be gone over once in ten days or two weeks or after hard rains which form a crust.

COVER CROPS.

About the middle of July or the first of August cover crops should be sown. These are of two kinds, leguminous and nonleguminous. Of the former the clover and hairy vetch for the North and cowpeas and soy beans for the middle and southern latitudes are perhaps the best. Hairy vetch is also sometimes used in the South. Of the nonleguminous cover crops rye is the most widely used, though in some sections, particularly in the North, buckwheat serves the purpose well.

The leguminous crops, besides being of value for the humus which they supply, add nitrogen to the soil. In fact they form the cheapest source of that element of plant food. In general they are the most desirable cover crops to use in an old orchard, although their use may possibly be overdone in young orchards. If the cover crop can be sown before the middle of July, red clover is probably best in the North, while cowpeas hold a relative position in warmer sections.

In seeding, from 12 to 15 pounds per acre of red clover should be used and sown broadcast, being covered with the smoothing harrow. One bushel of cowpeas per acre is a fair rate of seeding for that crop. They are usually sown broadcast. If it is impossible to sow the cover crop before the middle of July, especially in the North, hairy or winter vetch is better, because it grows later in the season than clover, which in the North will not usually make sufficient growth to pay if sown after the first of August. About a bushel of vetch seed per acre is required, making the seeding expensive.

If nonleguminous crops are to be used, rye is an excellent crop where it is not too much shaded. It may be sown any time between July 15 and October 15. In the warmer sections of the country, rye should not be sown too early when wanted as a winter cover crop, otherwise in the long season of growth which follows it will reach too great a degree of maturity. It grows rapidly and quite rank late in the fall and early in the spring and is very hardy. Two bushels of seed are required per acre. Buckwheat is nearly as good and may be sown up to September 1. It does not produce quite as much growth as rye, but grows even more rapidly. A bushel of seed per acre is sufficient. Neither of these crops adds plant food to the soil as do the legumes nor are their root systems as deep or extensive, but they probably produce more humus-forming material in a short time than clover. When good vigor is established in the apple orchard, leguminous and nonleguminous cover crops may be alternated, or they may be sown together. For the first few years, however, leguminous crops should be used. When sown together use a little more than half the regular seeding of each. The use of winter cover crops of course necessitates spring plowing.

SPRAYING.

It is always advisable and usually absolutely necessary to spray the old apple orchard. Not all diseases can be removed from the tree itself by pruning. An efficient spray thoroughly applied is needed to complete the renovation. Moreover, spraying is an insurance against disease or insects which may attack the fruit during the current season. It is seldom possible to produce absolutely clean fruit without spraying.

Sprays may be applied with any of several hand pumps well suited for the purpose and costing, with barrel, hose, nozzle, and all necessary attachments, from \$20 to \$50. Traction outfits used for spraying potatoes may be utilized with fair success on small orchards. If the orchard is larger than five or six acres it may pay to purchase a gasoline engine and outfit or a compressed-air outfit, especially where these outfits can also be utilized for other purposes.

COST OF RENOVATION.

The cost of the renovation described will be considerable, but no greater than the returns will warrant. The estimates shown in Table III have been carefully made from records obtained on several farms in New York State (fig. 8). The figures show the probable minimum and maximum cost per acre for the first year.



FIG. 8.—A small but very profitable general-farm orchard near a large city in eastern New York. The renovation of such old orchards near good local markets offers excellent opportunities for success.

TABLE III.—*Estimated cost of first year's work in renovating an old orchard.*

Item.	Estimated cost per acre.	
	Minimum.	Maximum.
Plowing.....	\$2.00	\$3.00
Manure, 10 to 20 loads, at \$1, or its equivalent in commercial fertilizer.....	10.00	20.00
Hauling manure, average, at 50 cents per load.....	5.00	10.00
Pruning and hauling brush.....	5.00	10.00
Disking or harrowing twice.....	1.00	1.50
Disking or harrowing third or fourth time.....	.50	1.00
Cultivation, 2 to 4 times.....	.50	1.00
Spraying once:		
Material.....	2.00	4.00
Labor.....	1.00	1.50
Total.....	27.00	52.00

For each additional spraying after the third, the cost should be increased correspondingly; that is, \$1.50 to \$2.50 per acre should be added.

It will thus be seen that the probable cost of the first year's work will be from \$30 to \$57 per acre, according to circumstances. On account of the shock to the tree of sudden change of treatment and because of the insufficient time for its good effects, the income the

first year will probably be very small and possibly nothing at all. After the first year, however, the income should increase each year to its maximum as the good effects of the treatment are obtained. It is, of course, evident that the cost and profit will vary with the thoroughness of the treatment, the number of trees per acre, and similar variant factors.

PROFITS FROM RENOVATED ORCHARDS.

Table IV gives the accurate record of a 6.1-acre orchard for eight years and will give the reader a good idea of the expense, income, and net profit on an average orchard in western New York for the period. The average yield during the eight years was 67 barrels per acre, which sold for an average price of \$2.33 per barrel. Culls and drops made up the remainder. The average cost of production was \$1.16 per barrel.

The expense included not only the usual items in the cost of production, such as pruning, cultivation, spraying, harvesting, marketing, etc., but land taxes, 5 per cent interest on the investment in equipment and on the land investment at \$150 per acre.

About one-half of the trees are 36 years old. The remainder are over 50 years old. The varieties are principally Baldwin, Twenty Ounce, and Tompkins King. The younger trees are set 32 by 32 feet, the older 28 by 56 feet (one-half having been cut out), and many trees are missing in both blocks. The orchard contains 243 mature trees.

TABLE IV.—*Income, expense, and net profits on a 6.1-acre apple orchard in western New York.*

Year.	Income.		Expense.		Net profit.	
	Total.	Per acre.	Total.	Per acre.	Total.	Per acre.
1902.....	\$913. 87	\$149. 81	\$519. 39	\$85. 15	\$394. 48	\$64. 66
1903.....	969. 89	159. 00	482. 56	79. 11	487. 33	79. 89
1904.....	559. 40	91. 70	360. 39	59. 08	199. 02	32. 62
1905.....	792. 25	129. 87	324. 31	53. 16	467. 94	76. 71
1906.....	818. 76	134. 22	401. 80	65. 87	416. 96	68. 35
1907.....	861. 45	141. 22	364. 40	59. 74	497. 05	81. 48
1908.....	1,362. 97	223. 44	583. 55	95. 67	779. 42	127. 77
1909.....	1,896. 79	310. 95	591. 93	97. 03	1,304. 86	213. 92
1910.....	1,008. 44	165. 32	399. 77	65. 54	608. 67	99. 78
9-year average.....	1,020. 42	167. 28	447. 57	73. 38	572. 85	93. 93

A characteristic example of orchard renovation is the case of a farmer in Monroe County, N. Y. A 4-acre orchard over 50 years old containing about 120 trees, mostly Baldwins (nearly half of the trees had died), had had no care whatever for at least 20 years to the writer's certain knowledge. The largest income ever obtained from this old orchard in its best year was \$400 and the average income was probably less than \$100.

Two years ago this farm changed ownership. The new owner was a good orchardist and began operations to renovate the orchard at once. Seventy-five loads of stable manure were applied and plowed under and the most thorough cultivation was practiced. About one-fourth of all the wood in the trees was removed and the trees were thoroughly sprayed.

The first year not more than \$25 worth of fruit was sold, but the second year the response to better methods was \$1,100 worth of fruit. Pruning has cost about \$50, plowing and cultivation \$75, spraying \$60, and fertilization \$100, a total of \$285, leaving a net profit for the first two years of operating of \$840, or \$210 per acre.

REFERENCES ON THE SUBJECT OF ORCHARD RENOVATION.

Those who care to pursue this subject further, or who desire to obtain more detailed information, particularly such as refers to the respective States, will find excellent material in three State experiment station bulletins:

Bulletin 253, Experiment Station of Michigan Agricultural College, "Can the General Farmer Afford to Grow Apples?" contains many valuable suggestions on improving apple orchards, together with some figures on the cost of renovation.

Bulletin 180, 1907, Ohio Agricultural Experiment Station, "Renewal of Old Orchards," is profusely illustrated with many excellent views of renovation methods.

Bulletin 61, part 2, Connecticut Agricultural Experiment Station, "Renovation of Old Apple Orchards," is invaluable for New England conditions and is also well illustrated.

SUMMARY.

(1) A large proportion of the farms in the older regions of the country have small apple orchards on them.

(2) These orchards should be made to produce a proportionate share of the income on the general farm.

(3) The present demand for apples makes it profitable to renovate many of these old orchards.

(4) The orchards it probably will not pay to renovate are those with but a few scattered old trees, with poor varieties, located unfavorably, or with many badly diseased trees.

(5) There are four principal steps to be taken in renovating an orchard. These are (a) pruning, (b) fertilization, (c) cultivation, and (d) spraying.

(6) Pruning should follow along the line of certain fundamental principles and with definite ends in view.

(7) Fertilization is very important in renewing old orchards, which are usually low in fertility. Manure is best for this purpose.

(8) Cultivation is very important. Clean culture until midsummer, followed by a cover crop of clover, hairy vetch, cowpeas, rye, buckwheat, or some other crop which is known to be of local value, is a practice usually to be recommended.

(9) Spraying is absolutely essential to the production of good fruit.

(10) Renovation costs from \$30 to \$57 an acre.

(11) Income varies with conditions, but may be expected to be well in advance of the cost after the first year.

(12) Examples cited show that a much greater profit can be obtained from many of these old orchards than from ordinary farm crops.

[A list giving the titles of all Farmers' Bulletins available for distribution will be sent free upon application to a Member of Congress or the Secretary of Agriculture.]